PROJECT FACT SHEET

CONTRACT TITLE: An Investigation of Dispersivity as a Reservoir Rock Characteristic

DATE REVIEWED: 01/12/93 **DATE REVISED:** 07/14/92

OBJECTIVE: This study will develop new methods to measure and interpret the dispersivity of a reservoir using Oxygen-18 and nuclear reaction analysis, and well log analysis. Dispersivity will be related to relative permeability. A new relationship of relative dispersivity will be defined.

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CONTRACT PERFORMANCE PERIOD:
07/12/90 to 07/11/93
PROGRAM: Lt Oil
RESEARCH AREA: Geoscience

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SCHEDULED MILESTONES:

Contract awarded	07/90
X-ray Imaging of Mixing Zone in Reservoir Cores	07/91
Comparison of conductivity and dispersivity of cores	07/92
Analytical model of dispersivity variation	07/93

FUNDING (1000'S)	DOE	OTHER	CONTRACTOR	TOTAL
PRIOR FISCAL YRS	333	0	108	**441**
FISCAL YR 1993	0	0	0	**0**
FUTURE FUNDS	0	0	0	**0**
TOTAL EST'D FUNDS	**333**	**0**	**108**	**441**

PROJECT DESCRIPTION: This laboratory study will attempt to establish dispersivity or the concentration profile (i.e., the S-shape curve) as an oil rock property and to use this reservoir rock property to aid in enhanced oil recovery operations. The study will involve measuring dispersion coefficients and dispersivities in consolidated porous media by measuring the degree of mixing of two miscible fluids as one fluid displaced the other. An attempt will be made to develop new ways to measure and interpret the dispersivity or the concentration profile, including use of Oxygen-18 water analysis, X-ray imaging core scanning methods, well log analysis, and miscible gas displacements. A standard method of measuring dispersivity in the field between wells will be developed.

PRESENT STATUS: Work has been continued on: (1) the experiments to determine the relationship between the flow system, dispersivity or dispersion coefficient, and the degree of presence of a second fluid phase which in this case is the connate water; (2) the establishment of a method to measure the transverse dispersion in a block of consolidated porous medium; and (3) the experiments to measure dispersion of gas-gas displacements on the core samples on which the concentration profiles were obtained from liquid-liquid displacements.

ACCOMPLISHMENTS: Work has been completed on the experiments to estimate the dispersivities of reservoir rocks from well logs and X-ray imaging of mixing zone in consolidated cores. A brief results of these investigations are presented below:
I-Through a key parameter of tortuosity, dispersivity is related to rock petrophysical properties. This semi-theoretical relationship forms the basis for determining dispersivities from well logs. The approach is validated through experimental studies on Berea and Brown Sandstone samples. It has been found that the equivalent dispersivity is an exponential function of the heterogeneity factor and can be used as a reservoir characteristic.
II-X-ray computed tomograph (CT) method and X-ray linear core scanning method were used to visualize the heterogeneity of rock and to measure in-situ dispersion of the miscible fluid flowing through core samples with different permeabilities, flow lengths, and heterogeneities. The results have shown that: (1) the concentration profile appears to be a strong function of rock permeability and heterogeneity; and (2) the dispersivity is a length dependent variable. A new parameter is defined and referred to as the dispersion factor. This dispersion factor is a single value which represents the characteristic of a concentration profile and it is independent of the system length. Moreover, the dispersion factor can be used to determine the flow characterization of a given medium under a miscible displacement process.

BACKGROUND: One limitation to producing oil unrecovered by conventional production is a lack of understanding of the dispersion phenomenon, which affects the unsteady mixing of two fluids displacing one another.

This dispersion is caused by two mechanisms: 1) the lengths of streamlines become variable due to division and rejoining of streamlines flowing through a disordered porous medium; and 2) as result of changing pore geometry and local pressure gradients, the speed along the streamline varies.

Previous research has developed a technique for measuring dispersivity of a reservoir rock and the relationship of dispersion to grain size and permeability for cores has been studied. It is now necessary to ascertain the scaling factor between dispersivity of a core sample and an actual field value, and to use this field dispersion characteristic to help characterize the reservoir.